Measurement of ω / $\phi \rightarrow e^+e^-$ in $\sqrt{s}$ = 200GeV proton + proton collisions at RHIC - PHENIX

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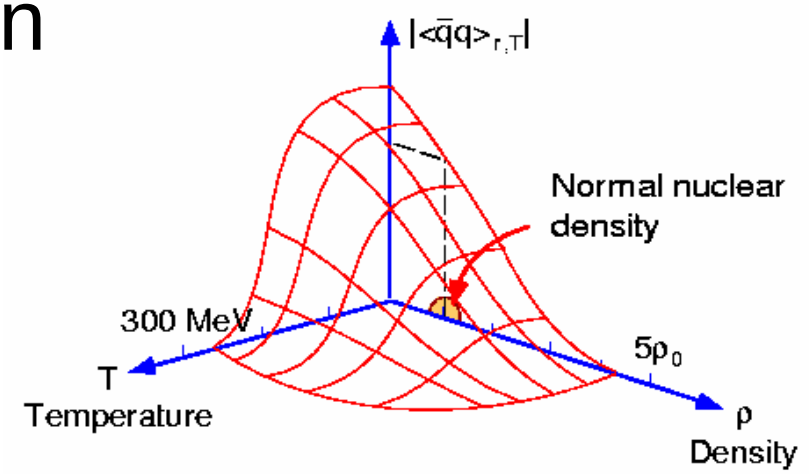
PHENIX

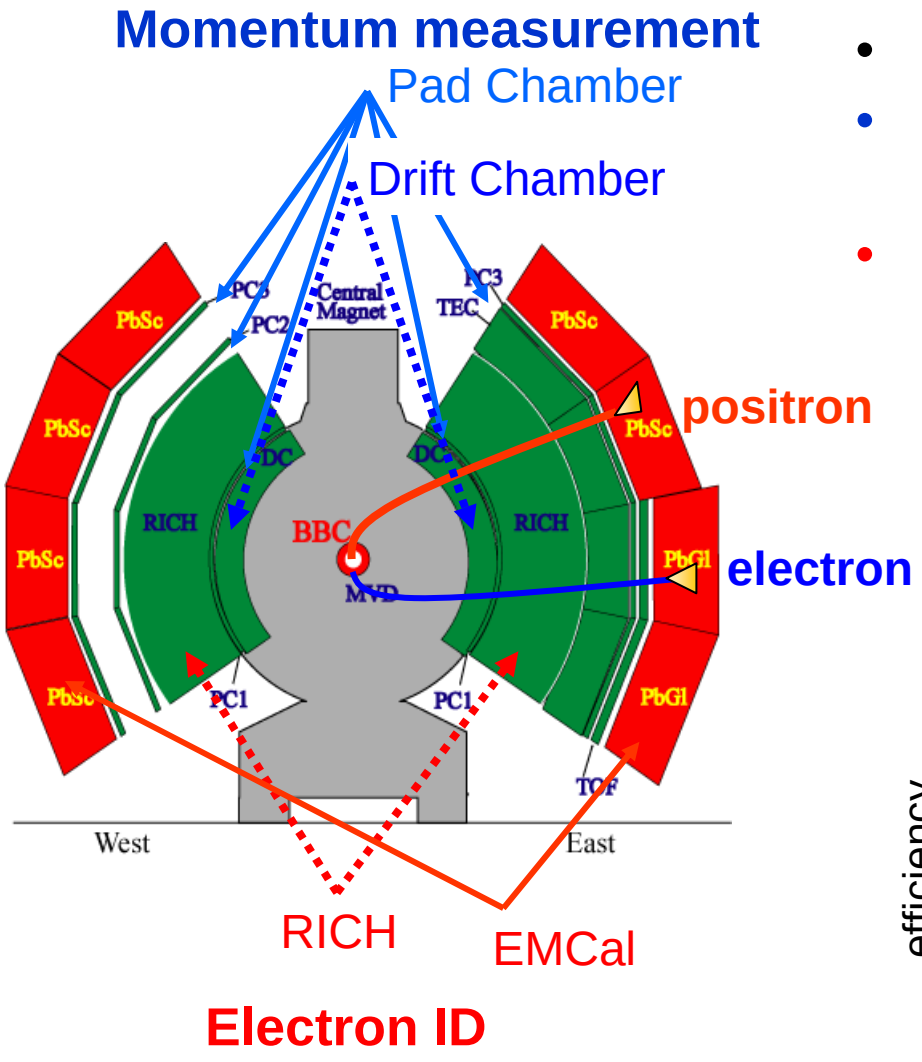
motivation



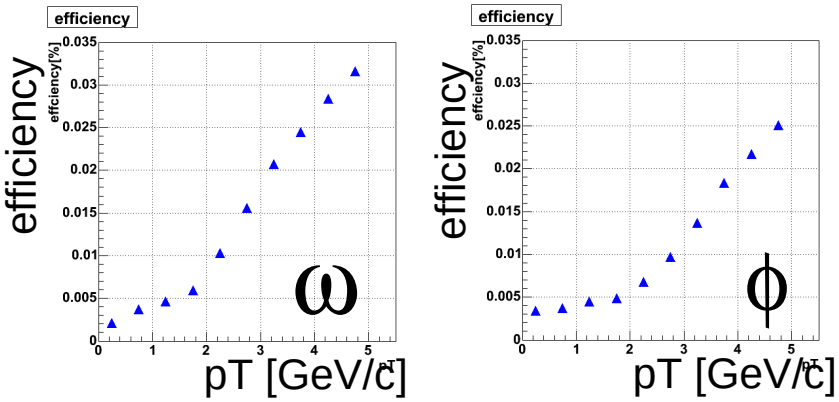
- light vector meson production carries information about possible <u>mass modification</u> at Heavy ion collision at RHIC.
  - Short life time ω:23fm/c ϕ:46fm/c
- proton + proton collision
  - **baseline** for the comparison to other decay mode and collision system.
    - Comparison with ω / ϕ → hadronic and → e^+e^-
    - Comparison with Au+Au, Cu+Cu, Au+d
- e^+e^- decay channel
  - ✓ Electron is good probe
    - → Not interact strongly in the medium
  - ✓ 2-body decay
  - ✓ measured ω / ϕ at low pT, where modification is expected

analysis of ω / ϕ → e^+e^- at proton + proton collisions

PHENIX Detectors



- Electron is measured by central arm.
- Momentum measurement
  - DC, PC
- Electron ID
  - RICH(Ring Image Cherenkov detector)
    - Separation of electron and charged pion less 5.0GeV/c
  - EMCal
    - Ratio between Energy deposited to EMCal and momentum
    - Electron is E/p ~ 1



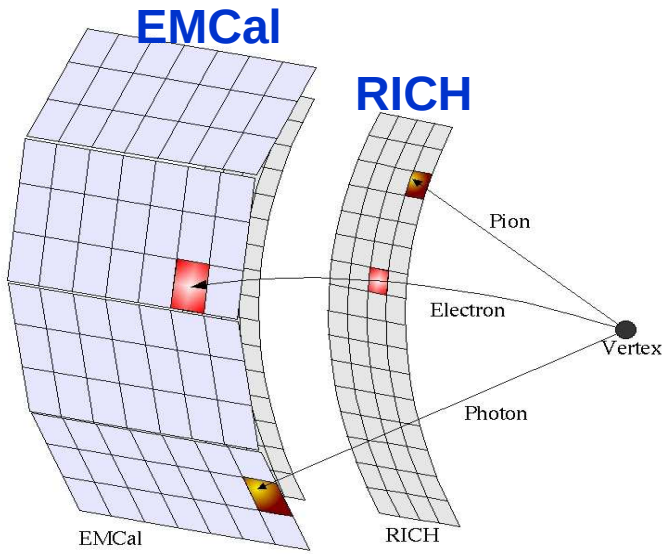
PHENIX acceptance

$-0.35 < \eta < 0.35,\ 0 < \phi < \pi$

Reconstruction efficiency including acceptance and eID obtained by simulation based on GEANT.

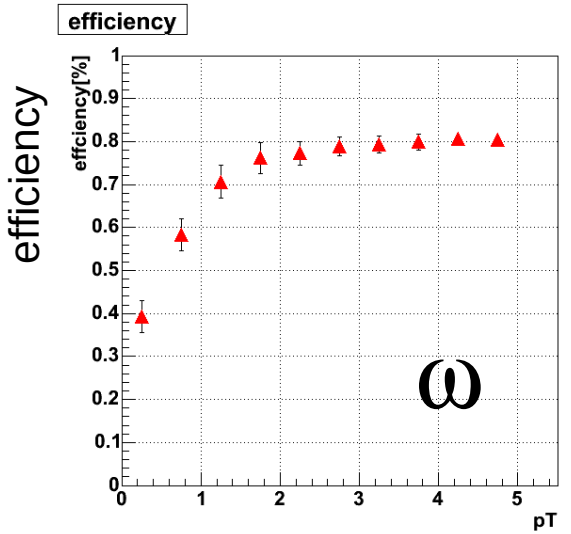
trigger

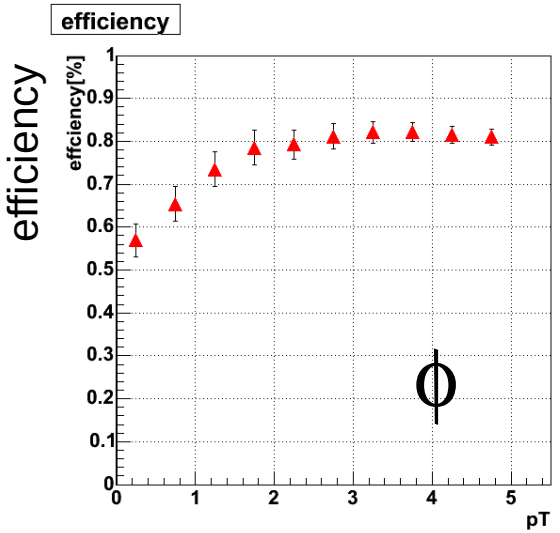
- To require the electron event effectively
- ERT (Emcal Rich Trigger)
  - ERT is single electron trigger
  - geometrical coincidence between RICH and EMCal hit
- ERT trigger efficiency of ω and ϕ is obtained by simulation based on GEANT.



Thresold(EMCal) = 400MeV/c

ERT trigger efficiency for ω and ϕ meson.





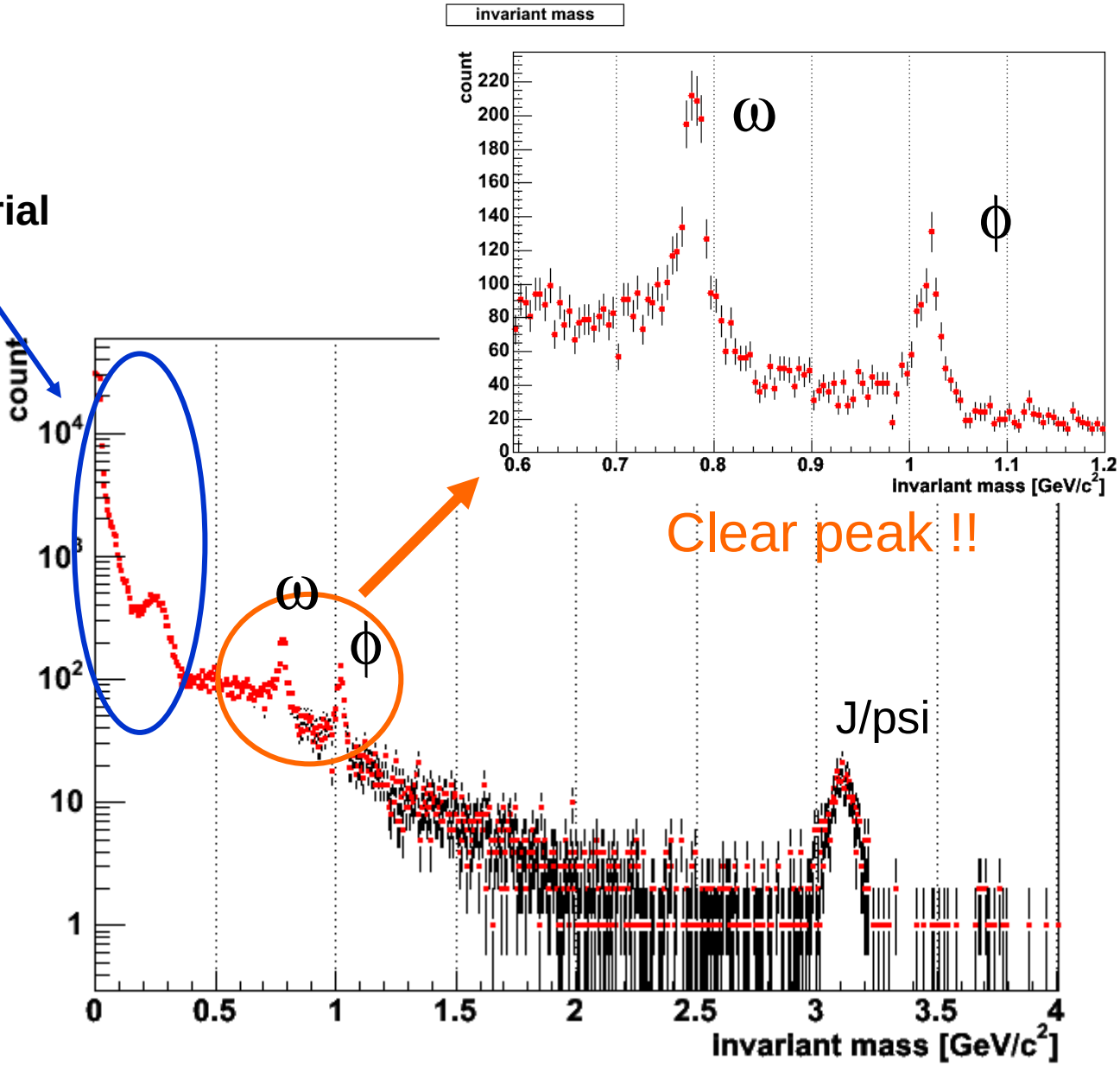
Invariant mass spectrum

Source of Combinatorial background

π^0 Daliz decay

Photon conversion

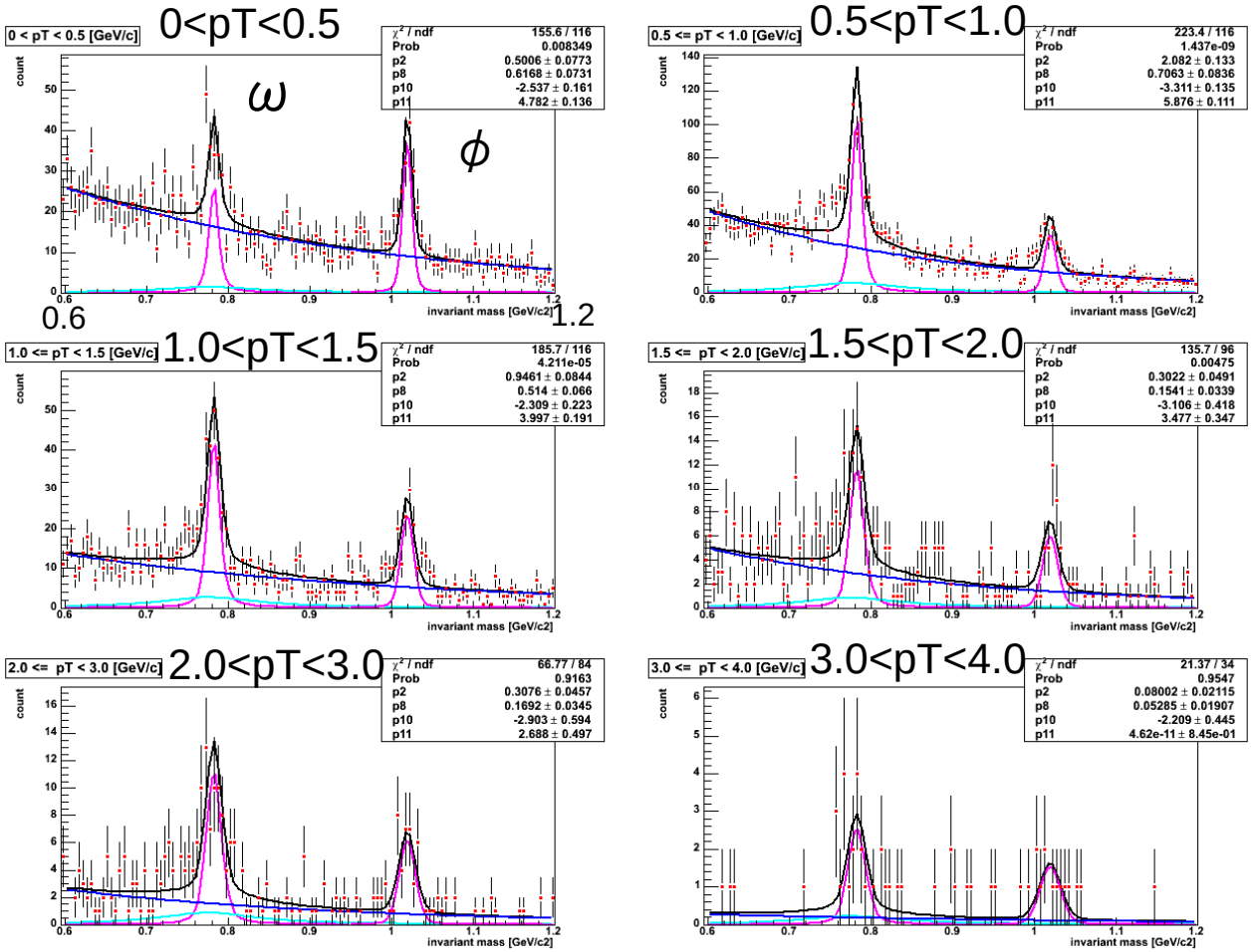
- bean pipe
- MVD
- edge of He bag



Invariant mass spectrum divided by pT

Fitting function is "**Gaussian convoluted Relativistic Breit-Winger** + **BW** + **exponential**".

ω and ϕ meson — ρ meson — **background**



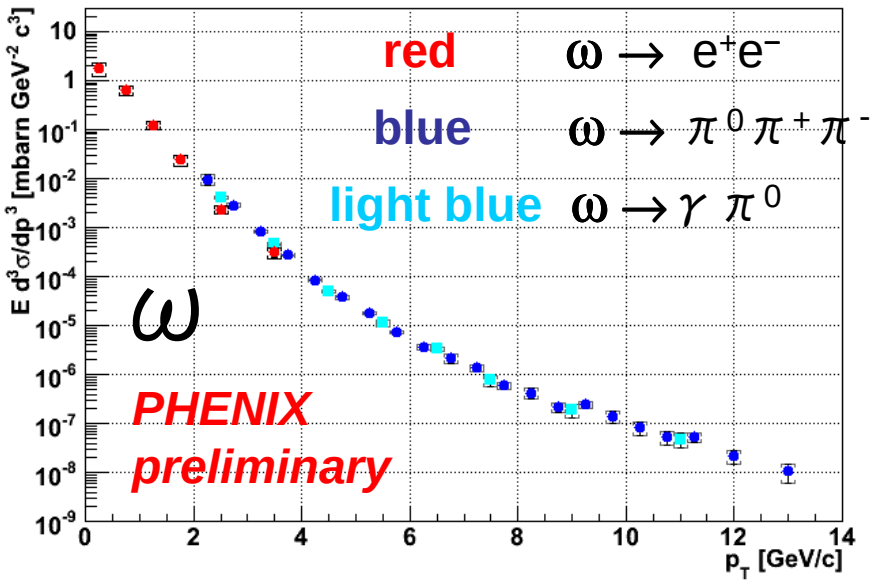
ω::*mass center*	782.6MeV/c^2
width	8.4MeV/c^2
ϕ::*mass center*	1.019.4MeV/c^2
width	4.5MeV/c^2
ρ::*mass center*	775.5MeV/c^2
width	149.4MeV/c^2
ρ/ω ratio	1.53

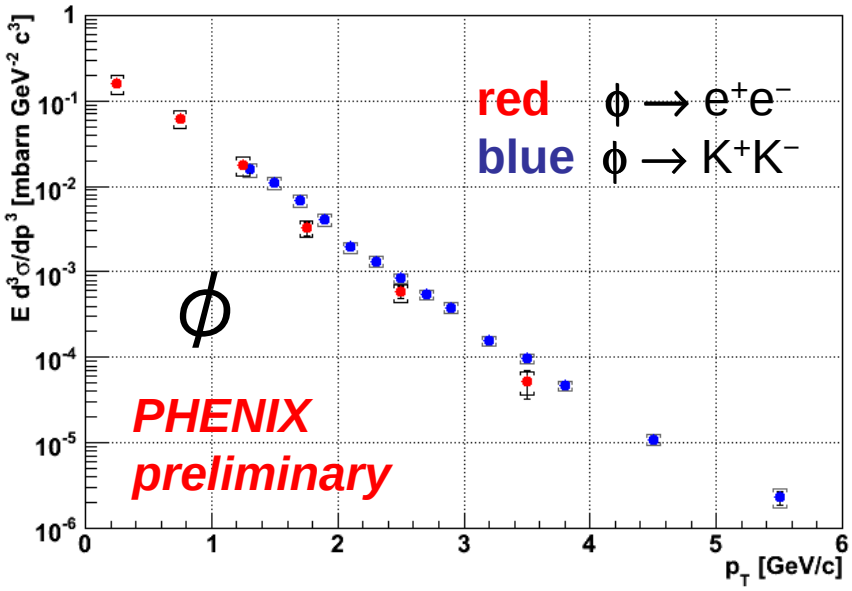
mass resolution was obtained from simulation.

We can see clear signal in ω/ϕ→ e^+e^- channel at pT<4.0GeV/c.

Invariant cross section

$\sqrt{s}$ = 200GeV proton + proton collisions





First result on the ω / φ → e⁺e⁻ in proton + proton at PHENIX.
The result is consistent with hadronic decay channel within statistic and systematic error.

The spectra of ω and φ meson are measured in pT range from 0.5 to 13GeV/c and 0.5 to 5.5GeV/c, respectively.

summary and outlook

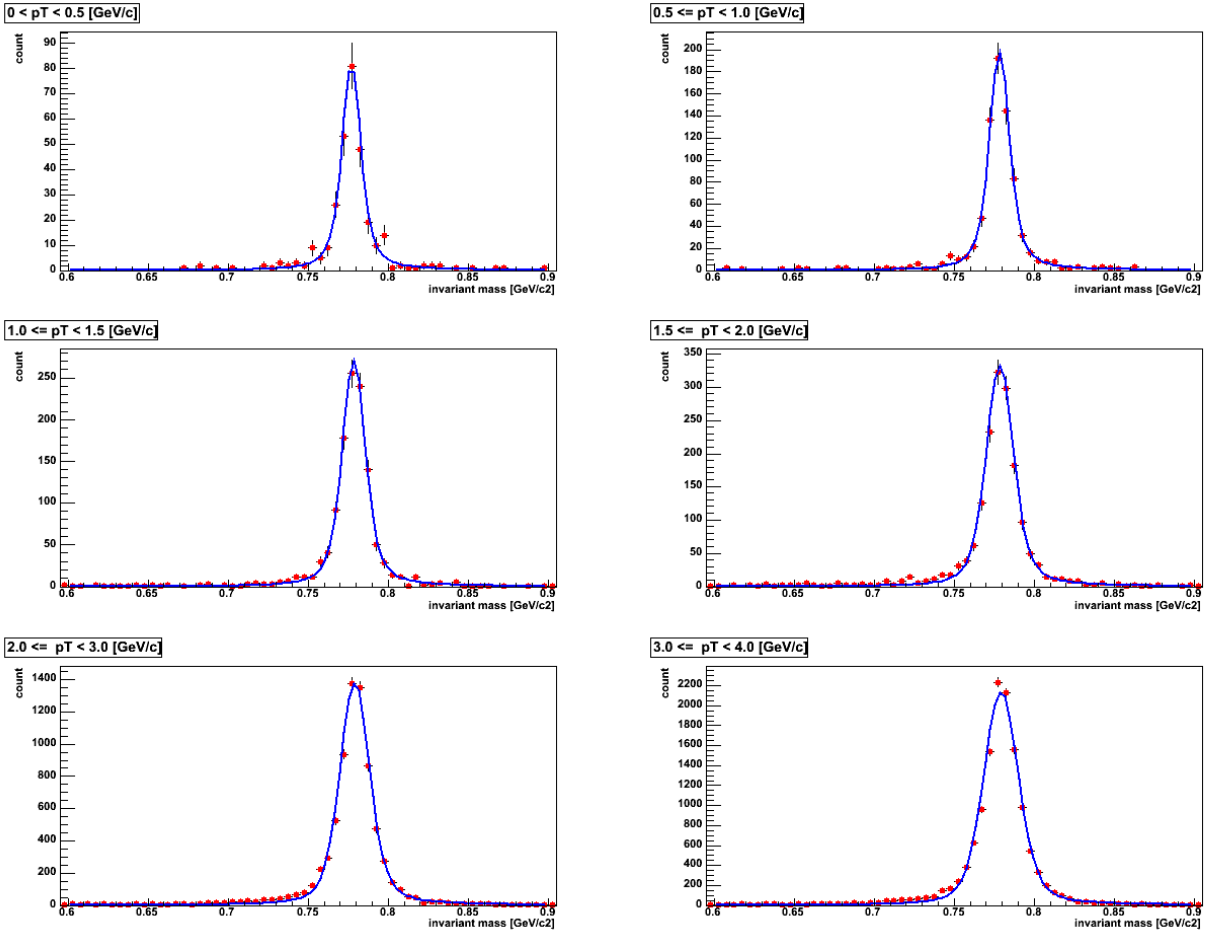
- The signal of ω / ϕ via di-electron pair at proton + proton collisions is seen clearly.
- Consistent with hadronic decay mode for both ω and ϕ mesons in p+p collisions.

- We should compare with other collision system (Au+Au, Cu+Cu, Au+d).
- Now ongoing!!

BACK UP

Invariant mass spectrum by simulation

ω



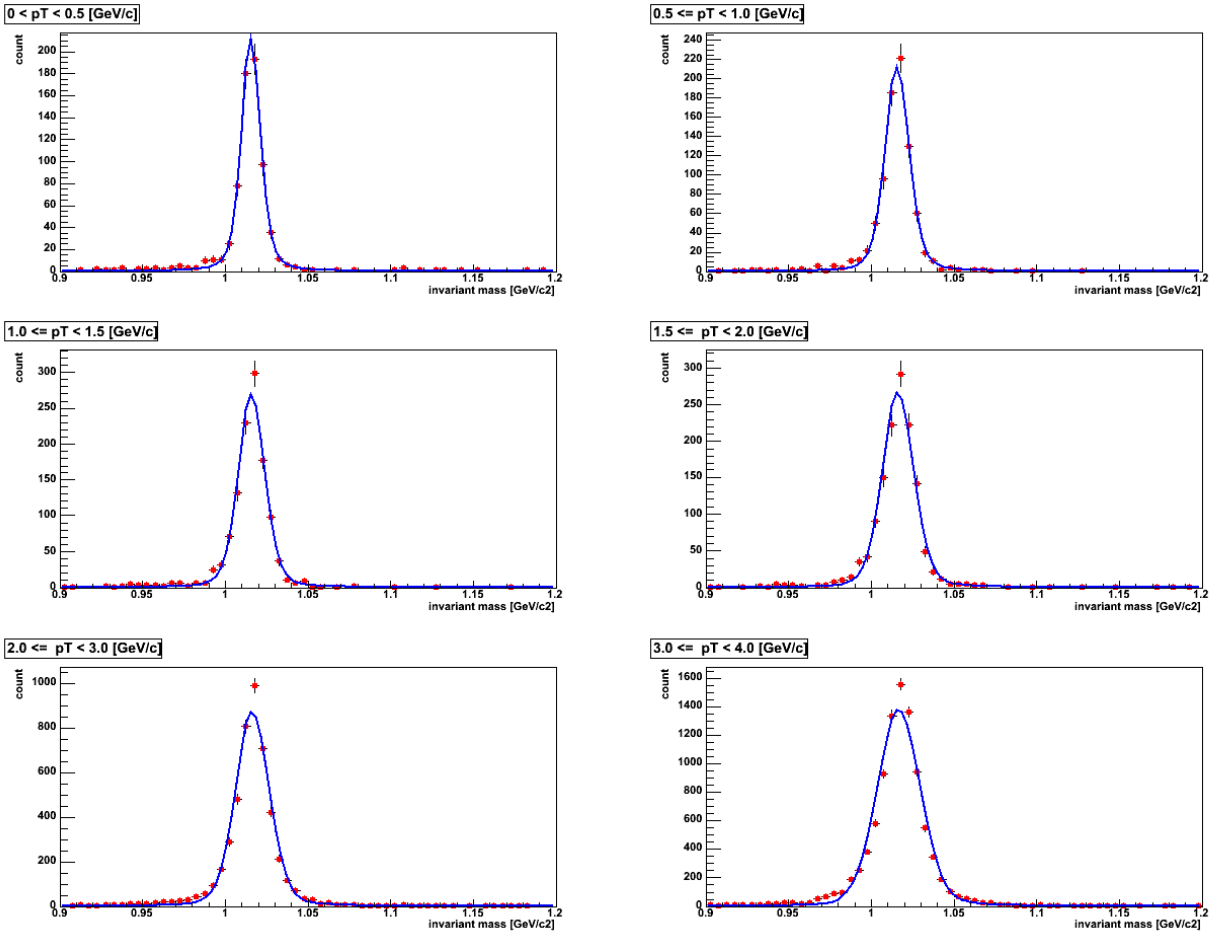
Gaussian convoluted Relativistic Breit-Wigner

Experimental mass resolution

pT	0.-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-3.0	3.0-4.0
omega $[MeV/c^2]$	3.8	4.3	5.3	6.7	7.4	9.0
phi $[MeV/c^2]$	4.8	6.4	7.0	8.5	9.2	12.1

Invariant mass spectrum by simulation

ϕ



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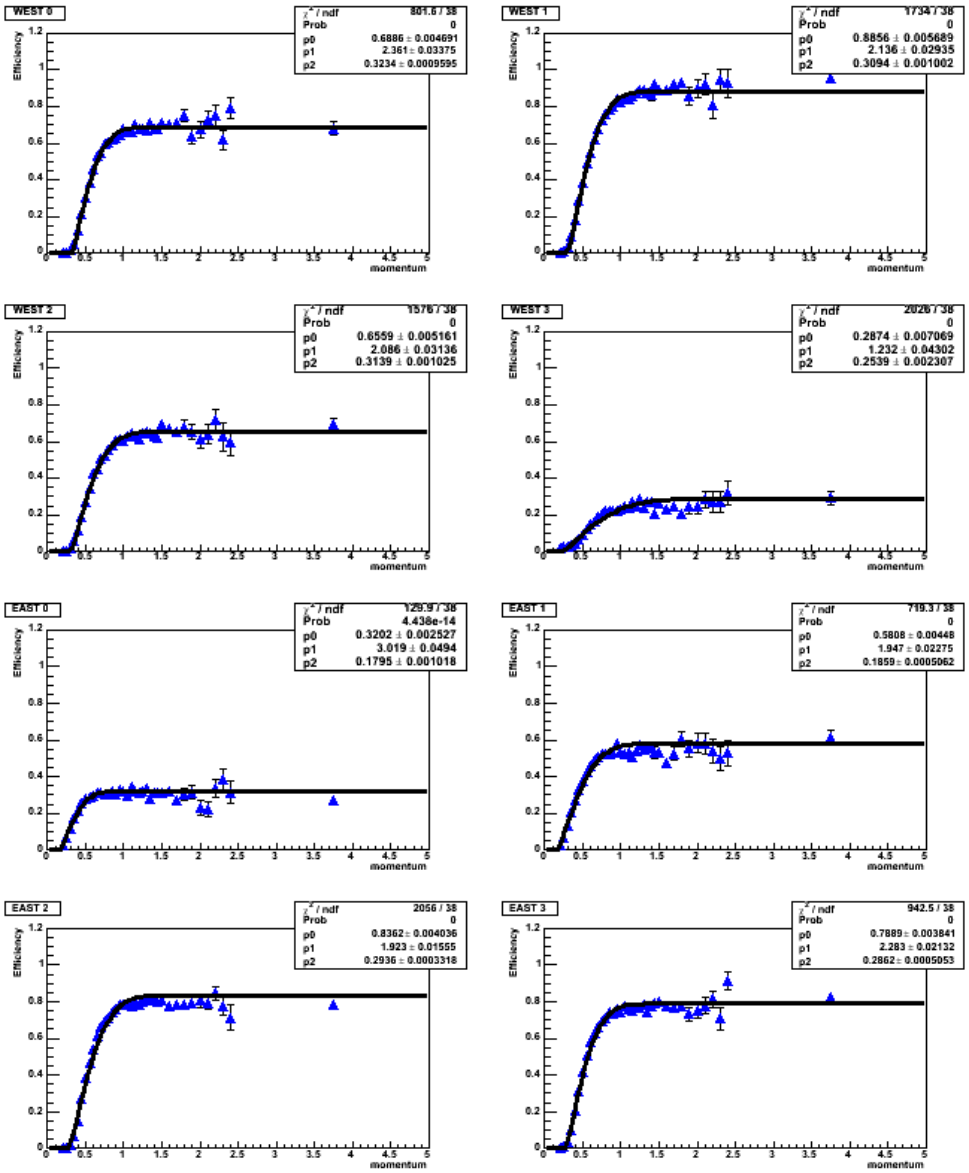
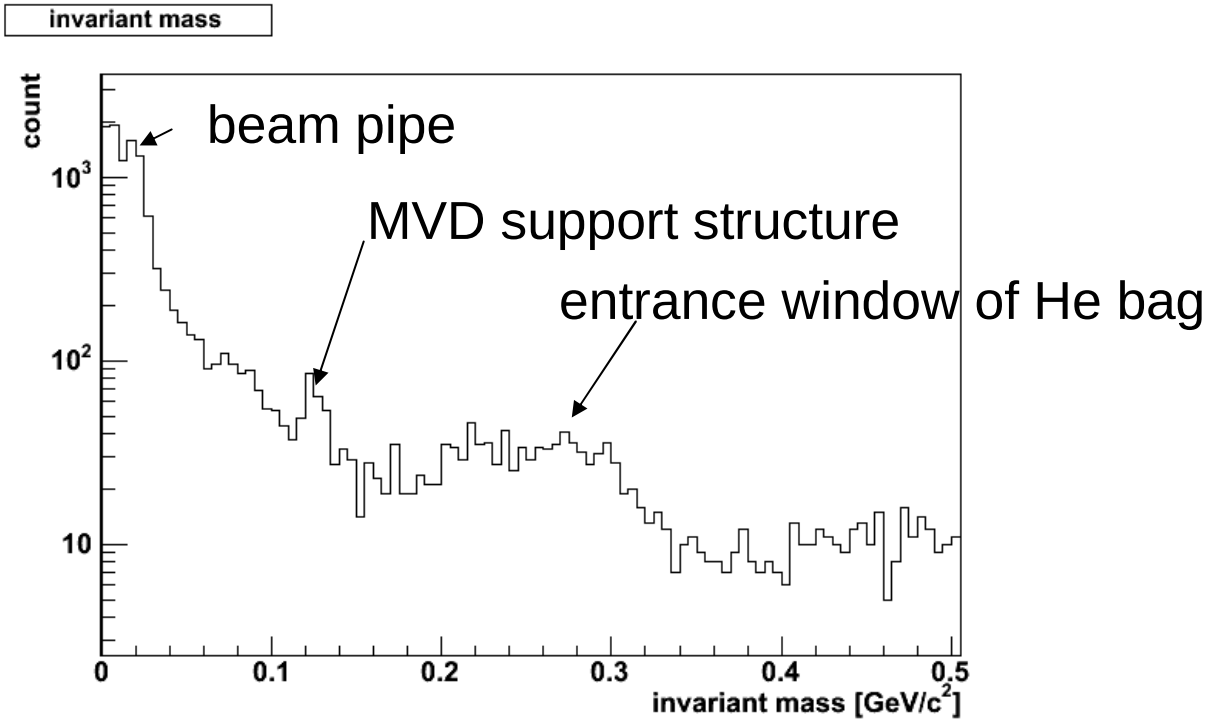
ERT electron trigger efficiency



conversion electron

- beampipe: radius 4cm, mass 20 MeV
- MVD support structures: radius 25cm, mass 120 MeV
- entrance window of He bag: radius 35-40cm, mass 220 MeV.



ω/π^0, ϕ/π^0 ratio